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Silviculture and Ecology of Upland Central Hardwood Forests Research Unit

Estimating D.B.H. of Southern Indiana Oaks From Stump Diameter

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Application

Estimates of tree diameter at breast height (d.b.h.) based on measurements of diameter at stump height (d.s.h.) can be used to reconstruct preharvest volume, value, structure, and composition of stands after a timber harvest. It may be necessary or useful to do this in cases of timber theft and trespass or in certain silvicultural and ecological research applications. This report presents estimates of d.b.h. for five upland oak species in southern Indiana based on d.s.h. measured 6 inches above ground on the uphill side of the tree (table 1). The composite model (the average of all species) can be used when it is difficult or impossible to distinguish among species.

Other models (see references cited below) may be more appropriate for use outside of southern Indiana. Models applied outside their area of origin should be tested against a sample of at least 30 pairs of d.b.h./d.s.h. measurements that are well distributed across the d.b.h. range of each species of interest. If there is acceptable agreement between the model and the test data, application of the model is likely to produce acceptable estimates. Data on the agreement of the models presented herein with other published models are presented in Johnson and Weigel (1990).

How The Models Were Developed

Because of the high correlation between d.b.h. and d.s.h., d.b.h. can be estimated with relatively high accuracy. We measured the d.b.h and d.s.h. of 1,021 oaks of five species in 10 stands in southern Indiana. The number of trees measured per species ranged from 98 for northern red oak to 413 for chestnut oak. Measurements were made to the nearest 0.04 inches at 4.5 feet above ground and at 6 inches above ground on the uphill side of each tree. Measurements were well distributed across the d.s.h. range of 3 to 36 inches in well-stocked upland hardwood stands; black oak site indices ranged from 60 to 75 feet at an index age of 50 years.

The models are given by the following non-linear regression equations:

- White oak-scarlet oak
  $d.b.h. = 0.7586(d.s.h.)^{0.9900}$

- Black oak-chestnut oak
  $d.b.h. = 0.9023(d.s.h.)^{0.9487}$

- Northern red oak
  $d.b.h. = 0.9634(d.s.h.)^{0.9130}$

- Composite model
  $d.b.h. = 0.8923(d.s.h.)^{0.9567}$

The R^2's for all models were >0.96.

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Table 1.—*D.b.h. of southern Indiana oaks estimated from stump diameter*

Stump diameter (in)[1]	White oak and scarlet oak	Black oak and chestnut oak	Northern red oak	Composite model
	- - - - - - - - D.b.h. outside bark (inches) - - - - - - - -			
3	2.3	2.6	2.6	2.6
4	3.0	3.4	3.4	3.4
5	3.7	4.2	4.2	4.2
6	4.5	5.0	5.0	5.0
7	5.2	5.7	5.7	5.8
8	6.0	6.5	6.5	6.6
9	6.7	7.3	7.2	7.3
10	7.4	8.1	7.9	8.1
11	8.2	8.8	8.6	8.9
12	8.9	9.6	9.3	9.7
13	9.6	10.3	10.1	10.4
14	10.4	11.1	10.8	11.2
15	11.1	11.8	11.5	12.0
16	11.8	12.6	12.2	12.7
17	12.6	13.3	12.8	13.5
18	13.3	14.1	13.5	14.2
19	14.0	14.8	14.2	15.0
20	14.8	15.6	14.9	15.8
21	15.5	16.3	15.6	16.5
22	16.2	17.0	16.2	17.3
23	17.0	17.8	16.9	18.0
24	17.7	18.5	17.6	18.8
25	18.4	19.2	18.3	19.5
26	19.1	20.0	18.9	20.2
27	19.9	20.7	19.6	21.0
28	20.6	21.4	20.3	21.7
29	21.3	22.1	20.9	22.5
30	22.1	22.9	21.6	23.2
31	22.8	23.6	22.2	24.0
32	23.5	24.3	22.9	24.7
33	24.2	25.0	23.5	25.4
34	25.0	25.7	24.2	26.2
35	25.7	26.5	24.8	26.9
36	26.4	27.2	25.5	27.6

[1] Measured outside bark 6 inches above ground.

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